

**Southern California Priority Corridor
Showcase Program Evaluation**

**Corridor-wide Strategic Planning Project
(CWSPP)
Evaluation Report**

**FINAL
VERSION 13.0**

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Disclaimer

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Abbreviations & Acronyms

ATIS	Advanced Traveler Information System
ATMS	Advanced Transportation Management System
AVL	Automatic Vehicle Location
Caltrans	California Department of Transportation
CORBA	Common Object Request Broker Architecture
COTS	Commercial Off-the-Shelf
CM	Configuration Management
CMP	Configuration Management Plan
CTC	California Transportation Commission
CVO	Commercial Vehicle Operations
CW	Corridor-wide
CWATIS	Corridor-wide Advanced Traveler Information System Project
CWATMS	Corridor-wide Advanced Transportation Management System Project
CWCVO	Corridor-wide Commercial Vehicle Operations Project
CWSIP	Corridor-wide Systems Integration Project
CWSPP	Corridor-wide Strategic Planning Project
DOIT	Department of Information Technology
EAP	Evaluation Activity Plan
EP	Evaluation Plan
FHWA	Federal Highway Administration
FSR	Feasibility Study Report
FTA	Federal Transit Administration
GPRA	Government Performance Reporting Act
GUI	Graphical User Interface
HP	Hewlett-Packard
HQIT	Headquarters - Information Technology (division of Caltrans)
IDL	Interface Definition Language
IPR	Intellectual Property Rights
ITS	Intelligent Transportation Systems
ISSC	Information Systems Service Center (division of Caltrans)
ISTEA	Intermodal Surface Transportation Efficiency Act (of 1991)
LACDPW	Los Angeles County Department of Public Works
LACMTA	Los Angeles County Metropolitan Transportation Authority
LADOT	City of Los Angeles Department of Transportation
LAN	Local Area Network
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
MTBF	Mean Time Between Failure
NDA	Non-Disclosure Agreement
NET	National Engineering Technology Corporation
NTR	Division of New Technology & Research (division of Caltrans)
OCTA	Orange County Transportation Authority
O&M	Operations and Maintenance

OS	Operating system (such as Windows™, Unix, Linux, et. al.)
PC	Personal Computer (Windows™-based)
RCTC	Riverside County Transportation Commission
RFP	Request for Proposals
RTP	Regional Transportation Plan
RTPA	Regional Transportation Planning Agency
RWS	Remote Workstation
SANBAG	San Bernardino Association of Governments
SANDAG	San Diego Association of Governments
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCPCSC	Southern California Priority Corridor Steering Committee
SIP	Systems Integration Plan
TEA-21	Transportation Equity Act for the 21st Century
TMC	Transportation Management Center
USDOT	United States Department of Transportation
VDS	Vehicle Detector Station
VOS	Volume/Occupancy/Speed
VCTC	Ventura County Transportation Commission
WAN	Wide Area Network

Executive Summary

Background

As required by federal law, all Intelligent Transportation System (ITS) projects that receive federal funding must undergo an evaluation to help assess the costs and benefits of ITS. This document is one of 23 reports produced as part of the Southern California ITS Priority Corridor Showcase Program Evaluation to help planners and decision-makers at the federal, state and local levels make well-informed decisions regarding future ITS deployments. This report presents the experiences, costs, and lessons learned from Southern California's Corridor-wide Strategic Planning Project (CWSPP).

In 1993, the U.S. Department of Transportation designated Southern California as one of four Priority Corridors in which ITS could have particular benefit. Southern California suffers from extreme traffic congestion, limited room for expanding transportation facilities, and above-average air pollution levels. The Southern California Priority Corridor includes the counties of Ventura, Los Angeles, Orange, San Bernardino, Riverside, and San Diego, and is one of the most populated, traveled, and visited regions in the country.

The ITS Showcase Program is one of several programs that have been implemented in Southern California's Priority Corridor to help aid mobility and mitigate traffic congestion and its associated environmental impacts. The Showcase Program consists of 17 ITS projects that collectively form a corridor-wide intermodal transportation management and information network between Los Angeles, Orange County, San Diego, and the Inland Empire. Each Showcase project deploys a piece of this corridor-wide ITS network, including regional Advanced Traveler Information Systems (ATIS), regional Advanced Transportation Management Systems (ATMS), and regional and interregional communications infrastructure. Eleven of the projects are regional in nature, while the remaining six are corridor-wide. The CWSPP is one of the six corridor-wide projects within the Southern California Priority Corridor ITS Showcase Program.

According to the final revised project workplan dated August 2000, the goal of the CWSPP was to "ensure that the systems of the Priority Corridor are interoperable and sustainable." The project was to accomplish this goal through the development of two deliverables: a Configuration Management Plan (CMP) and a Systems Integration Plan (SIP). The CMP was meant to help establish a process for controlling the development of the Priority Corridor systems and help ensure their ability to communicate and share information with one another. The SIP provides for the deployment of necessary interfaces to create an integrated, interoperable and sustainable corridor-wide ITS Showcase network.

Evaluation Findings and Recommendations

The Evaluation of the CWSPP resulted in the following findings and recommendations:

1. Per its work scope, the CWSPP team delivered both a Configuration Management Plan (CMP) and a Systems Integration Plan (SIP).
2. The CMP raised questions and disagreements over intellectual property rights and the ownership of publicly funded, custom-made software. Reviews of several Showcase project contracts revealed that agencies in the Priority Corridor vary in their attention to – and treatment of – intellectual property rights (IPR) and software ownership rights when they hire consultants to design and develop custom-made software. Although each agency has its own unique circumstances and the right to set its own policies, there may be advantages to developing and adopting a more standard and universal IPR/software ownership policy throughout the Priority Corridor.
3. The CMP proposed a “centralized” approach to configuration management in which a single entity would become the Showcase Network’s point-of-contact, information clearinghouse, and configuration manager for the entire multi-regional Priority Corridor. Although the CMP was rigorous in describing an ideal configuration management system, its “centralized” approach conflicted with the Corridor’s regionally-based planning and funding structure. Ultimately, the Steering Committee determined that the CMP should not apply to regional systems, and should only apply to the Corridor’s interregional components maintained by Caltrans (i.e., the Kernels and interregional network).
4. CM activities will be mainstreamed within the Regional Transportation Planning Agencies (i.e., LACMTA, OCTA, and SANDAG) and Caltrans. No federal funding for CM is anticipated.
5. The SIP identified several technical gaps limiting the interregional integration of the five Showcase projects/systems that it studied. Since these five projects were considered to be near completion, the CWSPP team recognized that these integration gaps would have to be dealt with in future projects. The SIP introduced the concept of an enhanced, “next-generation” Integrated Workstation (IWS) to replace the first-generation regional workstations that were being deployed. The Corridor-wide Advanced Traveler Information System (CWATIS) project is currently developing the Concept of Operations, Requirements, and High-Level Design for the IWS. A future project, the Corridor-wide Advanced Transportation Management System (CWATMS) project, will develop the Detailed Design and implement the IWS.

1 Introduction

1.1 Purpose and Scope of this Report

As required by federal law¹, all Intelligent Transportation System (ITS) projects that receive federal funding must undergo an evaluation to help assess the costs and benefits of ITS. The information provided in this report is intended to help planners and decision-makers at the federal, state and local levels make well-informed decisions regarding future ITS deployments based on the experiences of Southern California's Corridor-wide Strategic Planning Project (CWSPP).

This document is one of 23 reports produced as part of the Southern California ITS Priority Corridor Showcase Program Evaluation, and covers only the events and findings resulting from the CWSPP evaluation. The complete set of findings from the Showcase Program Evaluation are found in the following collection of documents:

Document Type/Title	Date	Document Number
17 Individual Project Evaluation Reports		
Corridor-wide ATIS Project Report	TBD	
Corridor-wide ATMS Project Report	TBD	
Corridor-wide CVO Project Report	TBD	
Corridor-wide Rideshare Project Report	TBD	
Corridor-wide Strategic Planning Project Report	10/29/2002	65A0030/0028
Fontana-Ontario ATMIS Project Report	TBD	
IMAJINE Project Report	TBD	
IMTMC Project Report	TBD	
InterCAD Project Report	TBD	
Kernel Project Report	TBD	
LA ATIS Project Report	TBD	
Mission Valley ATMIS Project Report	TBD	
Mode Shift Project Report	TBD	
OCMDI Project Report	TBD	
Traffic Signal Integration Project Report	TBD	
Transit Mgt System Project Report	TBD	
TravelTIP Project Report	TBD	
5 Cross-Cutting Evaluation Reports		
System Performance Cross-Cutting Report	TBD	
Costs Cross-Cutting Report	TBD	
Institutional Issues Cross-Cutting Report	TBD	
Information Management Cross-Cutting Report	TBD	
Transportation System Impacts Cross-Cutting Report	TBD	
Final Summary Evaluation Report		
Showcase Program Evaluation Summary Report	TBD	

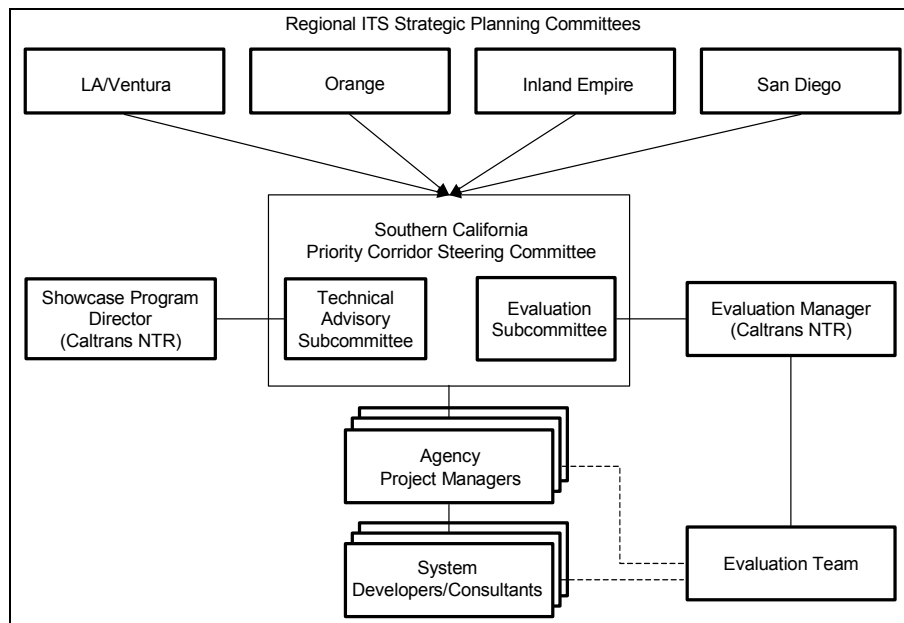
"TBD" indicates a future deliverable that is not yet available.

1.2 Evaluation Design and Approach

The findings outlined in this report are based on over four years of personal observations at project meetings, reviews of released project documents and agency memos, as well as formal and informal interviews and discussions with project partners.

The evaluation is responsive to the needs and suggestions of the Priority Corridor's Evaluation Subcommittee, which reports to the Priority Corridor's Steering Committee and is comprised of stakeholders from the federal, state, and local levels as shown in Exhibit 1.

Exhibit 1 – Management Structure and Organization of the Showcase Program



The Steering Committee's member agencies include:

- ▶ California Highway Patrol (CHP)
- ▶ Caltrans, Division of New Technology & Research (NTR)*
- ▶ Caltrans, District 7*
- ▶ Caltrans, District 8*
- ▶ Caltrans, District 11*
- ▶ Caltrans, District 12
- ▶ City of Irvine*
- ▶ City of Los Angeles Department of Transportation (LADOT)
- ▶ City of San Diego
- ▶ Federal Highway Administration (FHWA)*
- ▶ Federal Transit Administration (FTA)
- ▶ Los Angeles County Metropolitan Transportation Authority (LACMTA)
- ▶ Orange County Transportation Authority (OCTA)
- ▶ Riverside County Transportation Commission (RCTC)
- ▶ San Bernardino Association of Governments (SANBAG)
- ▶ San Diego Association of Governments (SANDAG)
- ▶ South Coast Air Quality Management District (SCAQMD)
- ▶ Southern California Association of Governments (SCAG)
- ▶ Ventura County Transportation Commission (VCTC)

* Indicates an Evaluation Subcommittee member

The Showcase Program's Evaluation Design is based on a set of evaluation Goals and supporting Objectives and Measures that were developed by the Evaluator in partnership with federal, state and local stakeholders, and documented in the "Showcase Program Evaluation Approach" in 1998. Each individual Showcase project is evaluated based on an applicable subset of these Goals, Objectives, and Measures so that summary evaluation results might be aggregated from across the multiple Showcase project evaluations. The Showcase Program's five evaluation Goals include:

- ▶ Evaluate System Performance
- ▶ Evaluate Costs
- ▶ Evaluate Institutional Issues and Impacts
- ▶ Evaluate the Use and Management of Transportation/Traveler Information
- ▶ Evaluate Transportation System Impacts

As the CWSPP evolved, project-specific refinements to the evaluation design were documented in a high-level Evaluation Plan (EP) and a detailed Evaluation Activity Plan (EAP). In general, the EP describes the project and/or system under evaluation, and lays the foundation for further evaluation activities by developing consensus among the Evaluation Subcommittee and project

partners as to which of Showcase's evaluation Goals, Objectives, and Measures best apply to the project. Since the CWSPP did not develop, modify, install, or integrate any physical systems, the Evaluation Subcommittee concurred that the CWSPP evaluation should focus only on System Performance (to the extent of evaluating "project performance"), Costs, and Institutional Issues and Impacts.

As the project matured, and after the EP had been approved, an EAP was developed to plan, schedule, and describe specific activities (interviews, surveys, etc.) and step-by-step procedures for conducting the evaluation. Data collection began after both plans had been reviewed and subsequently approved by the Evaluation Subcommittee and the project's partners.

1.3 Organization of this Report

The CWSPP Evaluation Report provides a background description of the Southern California Priority Corridor and the transportation challenges it faces. The background description is followed by descriptions of the Showcase Program and then, more specifically, the CWSPP. Evaluation findings are subdivided and ordered according to the three applicable evaluation Goals described below:

Project/System Performance — The Project/System Performance evaluation describes the development and evolution of the project, including its overall approach and major milestones achieved, in order to provide insight into best practices and lessons learned.

Cost — The Cost evaluation provides important benchmark information regarding applicable funding sources, development costs, and operations and maintenance (O&M) costs.

Institutional Impacts — The Institutional Impacts evaluation provides important information regarding the administrative, procedural and legal impacts resulting from the CWSPP. Such impacts include changes in operator workloads, job responsibilities and employee turnover rates, as well as changes to and limitations of agency-wide policies, procedures and guidelines.

Since the CWSPP provided a service and did not develop, modify, install, or integrate any physical systems, the Evaluation Subcommittee and the project partners concurred that an evaluation of Transportation & Traveler Information Management (Evaluation Goal 4) and Transportation System Impacts (Evaluation Goal 5) did not apply and was not warranted.

This report concludes with a summary of findings and recommendations.

1.4 Privacy Considerations

Some of the information acquired in the interview and discussion process could be considered sensitive and has been characterized in this report without attribution. The Evaluator has taken

precautions to safeguard responses and maintain their confidentiality. Wherever possible, interview responses have been aggregated during analysis such that individual responses have become part of a larger aggregate response. The names of individuals and directly attributable quotes have not been used in this document unless the person has reviewed and expressly consented to its use.

1.5 Constraints & Assumptions

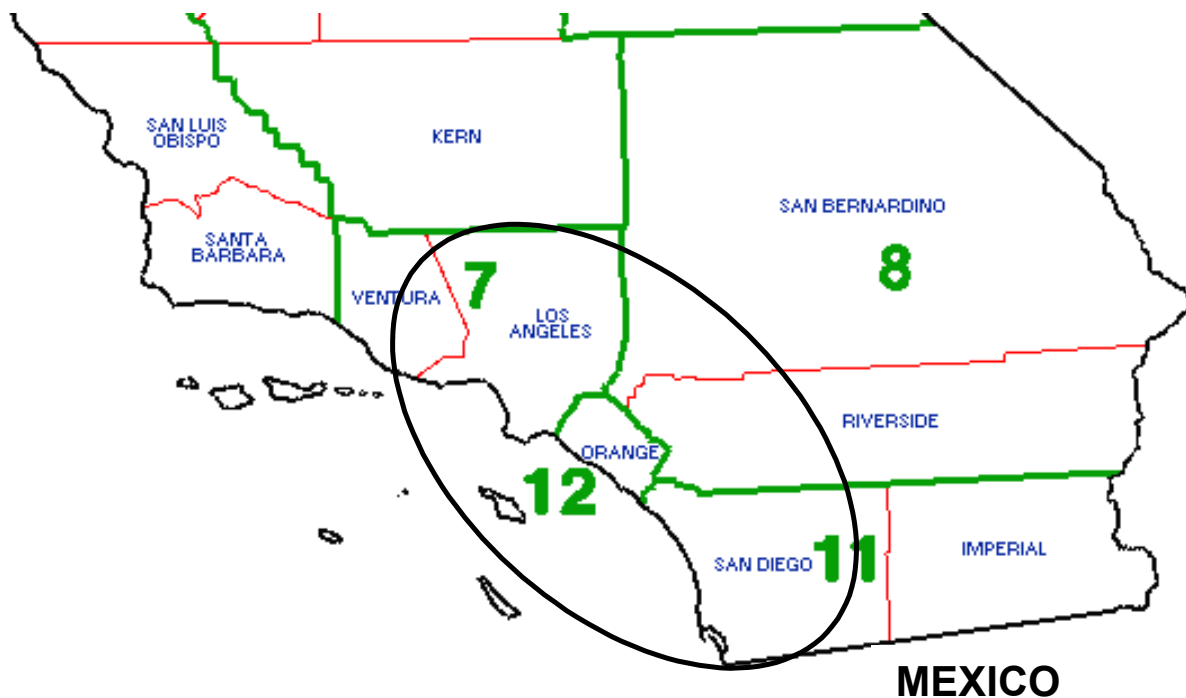
The CWSP evaluation is subject to the following constraints and assumptions:

- ▶ The CWSP was not intended to design, develop, modify, install or integrate any hardware or software, so there is no associated physical system to evaluate with regards to System Performance, Transportation & Traveler Information Management, nor Transportation System Impacts.
- ▶ The project's consultant was not required to disclose actual project expenses, so the project's cost is based on the budget stipulated in the CWSP contract and any amendments. Since the contract was fixed-price, the budget may not accurately reflect actual expenses and costs.

1.6 Project Background

1.6.1 The Southern California Priority Corridor

In 1993, the U.S. Department of Transportation designated Southern California as one of four Priority Corridors in which Intelligent Transportation Systems (ITS) could have particular benefit. Southern California suffers from extreme traffic congestion, limited room for expanding transportation facilities, and above-average air pollution levels. The Southern California Priority Corridor, illustrated in Exhibit 2, is one of the most populated, traveled, and visited regions in the country.

Exhibit 2 – The Southern California Priority Corridor and Vicinity

The Southern California Priority Corridor includes the more heavily populated coastal region of Southern California, including most of Ventura County, all of Los Angeles County and Orange County, the western half of San Diego County (including the international border with Mexico), and the (south) western portions of San Bernardino and Riverside Counties. Roughly two-thirds of the state's population – about 20 million people – resides in or around the Southern California Priority Corridor.

Exhibit 3 – Population and Number of Registered Vehicles by County

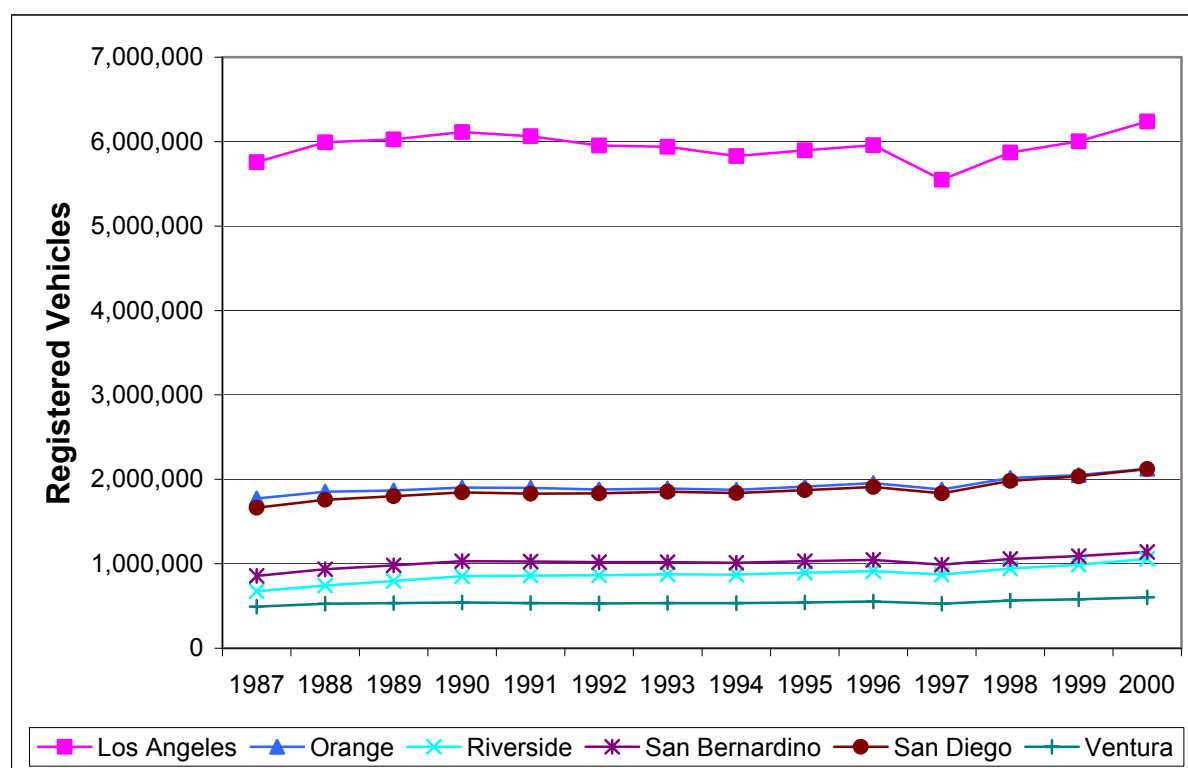
County	Population ² (as of 7/1/2001)	Registered Vehicles ^{3*} (as of 12/31/2000)	Caltrans District
Los Angeles	9.7 million	6.2 million	7
Orange	2.9 million	2.1 million	12
San Diego	2.9 million	2.1 million	11
San Bernardino	1.8 million	1.1 million	8
Riverside	1.6 million	1.1 million	8
Ventura	0.8 million	0.6 million	7
Imperial	0.15 million	0.1 million	11
Total	19.85 million	12.7 million	

*Includes autos, trucks, and motorcycles. Trailers not included.

There is no question that California faces a glut of automobiles; Southern California alone is home to roughly 9% of the nation's registered automobiles. In state-by-state comparisons, California is shown to have more than twice as many automobiles as New York, Texas or Florida.

California's large automobile count coincides with its economic vitality and the required mobility of its workforce. As shown in Exhibit 4, Southern California experienced a significant increase in its number of registered vehicles during the economic expansion of the late 1980's. The number stabilized during the economic cool-down of the early and mid-1990's, but began to increase again in the late 1990's as the economy heated up due to advances in biomedical research and information technology.

Exhibit 4 – Number of Registered Vehicles in Southern California Since 1987⁴



California's economic strength and urban sprawl require that its workforce be mobile. In addition to automobiles, the region has several public transit alternatives, as are described in Exhibit 5. Note that this is only a sample listing, and does not include many smaller municipal or contract services.

Exhibit 5 – Major Public Transit Service Providers in Southern California

Transit Service	Mode	Service Area	Annual Unlinked Passenger Trips⁵
Coaster	Commuter Rail	• San Diego County	1,187,800
Metrolink (Southern California RR Authority)	Commuter Rail	• Los Angeles County • Orange County • San Diego County	6,978,600
MTA (Metro Rail)	Heavy/Light Rail	• Los Angeles County	57,817,300
MTA (Metro Bus)	Bus	• Los Angeles County	347,451,300
MTDB/NCTD	Bus	• San Diego County	64,527,400
OCTA	Bus	• Orange County	55,526,700
San Diego Trolley	Light Rail	• San Diego County	28,743,300
Riverside Transit	Bus	• Riverside County	6,350,200

1.6.2 The Southern California Priority Corridor's ITS Showcase Program

The ITS Showcase Program is one of several programs that have been implemented in Southern California's Priority Corridor to help aid mobility and mitigate traffic congestion and its associated environmental impacts.

Exhibit 6 lists the 17 ITS projects in the Showcase Program. These projects collectively form a corridor-wide intermodal transportation management and information network between Los Angeles, Orange County, San Diego, and the Inland Empire. The projects have been funded, approved, and are prioritized and phased through an ongoing comprehensive scoping and high-level design process. Eleven of the projects are regional in nature, while the remaining six are corridor-wide in scope.

CWSPP is one of the 17 projects that comprise the Southern California Priority Corridor ITS Showcase Program. The 17 Showcase projects are listed below by region. Eight of the projects were fast-tracked and designated "Early Start" projects because of their importance as base infrastructure and potential to act as role models for the rest of the Showcase Program.

Exhibit 6 – The 17 Showcase Projects and their Status as of July 2002

Project	RFP Issued	Contractor Selected	Contract Executed	Project Underway	Project Complete
Corridor-wide					
Scoping & High Level Design (Kernel)*	✓	✓	✓	✓	✓
Strategic Planning/Systems Integration	✓	✓	✓	✓	✓
CVO ☐					
ATIS	✓	✓	✓	✓	
ATMS ☐					
Rideshare	✓	✓	✓	✓	
Los Angeles Region					
IMAJINE*	✓	✓	✓	✓	✓
Mode Shift*	✓	✓	✓	✓	
LA ATIS	✓	✓	✓	✓	
Inland Empire Region					
Fontana-Ontario ATMIS	✓	✓	✓	✓	
Orange County Region					
TravelTIP*	✓	✓	✓	✓	✓
OCMDI	✓	✓	✓	✓	✓
San Diego Region					
InterCAD*	✓	✓	✓	✓	✓
Mission Valley ATMIS*	✓	✓	✓	✓	
IMTMS/C (ATMSi)*	✓	✓	✓	✓	
Traffic Signal Integration (RAMS)	✓	✓			
Transit Management System*	✓	✓	✓	✓	

* Indicates an "Early Start" project.

☐ CWCVO and CWATMS do not yet have approved workplans.

2 Project Description

Up until final contract approval, the project was referred to as the Corridor-wide System Integration Project (CWSIP). Early draft workplans for the CWSIP envisioned that the project would oversee the corridor-wide integration of regional systems and fill-in any gaps that the regional projects left behind. However, as the regional systems took shape, and plans within the corridor evolved, the scope of the CWSIP also evolved. The workplan became less involved with physical systems integration, and focused more on planning and corridor-wide configuration management. An RFP was published in late May or early June 1999 and a consultant (TransCore) was selected in late July, whereupon contract negotiations began. The negotiations ended successfully in October 1999, but in order to gain final contract approval from Caltrans' Information Systems Service Center (Caltrans ISSC; now Caltrans HQ IT), the project was renamed the Corridor-wide Strategic Planning Project (CWSPP) in November 1999. The project officially kicked-off on December 8, 1999.

According to the final revised project workplan dated August 2000, the goal of the CWSPP was to “ensure that the systems of the Priority Corridor are interoperable and sustainable.” The project was to accomplish this goal through the following four tasks:

Task 1 – Develop a Configuration Management (CM) Plan

Task 1 prepares a Configuration Management Plan to help establish a process to control the development of the Priority Corridor systems and ensure their ability to communicate and share information with one another. The intent is that the CM process would be integrated into each Showcase project via a Memorandum of Understanding (MOU) with the managing agency.

Task 2 – Implement Selected CM Plan Elements

Task 2 initiates the implementation of the CM process for a few designated Showcase projects, which include TravelTIP, IMAJINE, InterCAD, Mission Valley ATMIS, and the Kernel. Task 2 also establishes the baselines against which acceptance testing, as called for in Task 3, can be performed.

Also as part of Task 2, the CWSPP team was to organize a Configuration Control Board and an Interface Control Working Group.

Task 3 – Systems Integration and Analysis

Task 3 verifies and validates the interfaces between the designated projects, and performs a corridor-wide gap analysis. This is accomplished through oversight, review and participation in the acceptance and integration testing of the designated projects (including the Kernel and the Seeds) through the following activities:

- ▶ Review each Test Plan/Procedure to ensure it is based on the baseline functional requirements for these items and includes test cases that verify that those functional requirements have been met
- ▶ Show a clear trace from the baseline requirements to test cases
- ▶ Verify that each Plan/Procedure includes a description of the testing process, identification of roles and the resources for those roles, test support requirements, test readiness criteria, the test discrepancy resolution process and test reporting requirements.
- ▶ Witness the performance of each test by the respective project
- ▶ Review the analyses of the test results by the Designated Project Developers to determine if the test criteria have been met
- ▶ Work with the project developers to develop and implement a plan for resolving each test discrepancy
- ▶ Prepare a Test Completeness Report on each conducted test

Task 3 would also prepare a corridor-wide communications bandwidth analysis of initial and future Priority Corridor deployments to identify design deficiencies and suggest approaches for possible improvement. This would help identify operational and administrative requirements of the Showcase network. This subtask was later dropped because another Showcase project already contained a similar task (Scoping & Design, Task 19).

Task 4 – Develop System Integration Plan

Task 4 develops a System Integration Plan for the deployment of necessary interfaces to create an integrated, interoperable and sustainable corridor-wide system. Task 4 reviews the Concept of Operations for each Priority Corridor system, and for the integrated network, in order to determine the rationale and the need to create a link between each type of system (and between multiple instances of a single system) based on the system's purpose and location. From this analysis, Task 4 develops a System Integration Plan to determine what should be integrated, by whom and when.

The CWSPP evaluation was conducted based on this understanding of the project's goals and tasks.

3 System Performance Evaluation

3.1 *The Project/System Development Process and Timeline*

This section describes the CWSPP's approach to completing its tasks, and explains the impacts that the project had on the rest of the Showcase Program. Although the CWSPP did not develop, modify, install, or integrate any physical systems, its purpose was to help ensure the integration and continued interoperability of other Showcase projects through the development of two primary deliverables:

- ▶ Configuration Management Plan (described in section 3.1.1)
- ▶ Systems Integration Plan (described in section 3.1.2)

Together, these two documents would provide the following benefits:

- ▶ Ensure the Priority Corridor design incorporates what was specified
- ▶ Smooth the integration of the projects that make up the Showcase Network
- ▶ Ensure interoperability
- ▶ Ensure sustainability
- ▶ Ensure maintainability
- ▶ Provide a repository of baselines and Configuration Management (CM)
- ▶ Support orderly control of changes

Although the entire Showcase Program consists of 17 projects, timing and budget issues forced the CWSPP to focus its efforts on the five projects that were closest to completion at the time (hereafter referred to as the “designated projects”). The five designated projects included:

- ▶ Kernel (v0.3 & v1.0)
- ▶ IMAJINE
- ▶ TravelTIP
- ▶ Mission Valley ATMIS
- ▶ InterCAD

3.1.1 Configuration Management Plan (CMP)

The CMP is the result of two workshops and several document review cycles. The project team presented initial thoughts and plans regarding development of the CMP to Priority Corridor stakeholders at the project's kick-off meeting and first workshop on December 8, 1999. The project team explained its goals and identified a number of items that it wanted to begin collecting from the designated projects. These items included:

- ▶ System design documents
- ▶ Software source code (sufficient to build the executable)
- ▶ Description of software build environment
- ▶ Description of test environment

The project team further requested copies of any compilers and build instructions so that they could verify that the source code they receive is sufficient, correct and complete. This request immediately raised concerns among Showcase's systems engineering contractors, who pointed out that "hundreds" of software components go into making an application. Many of the components are off-the-shelf, tend to be expensive, and often have non-transferable licenses.

A second CM workshop was held at TransCore's Anaheim facility on April 28, 2000 to present the draft CMP and gather stakeholder feedback before presenting the document to the Steering Committee at its May meeting.

The updated CMP was presented at the May 2000 Steering Committee meeting, and the Steering Committee requested that the Technical Advisory Subcommittee (TAS) review the Plan and bring back a recommendation to approve or revise.

The CMP was revised to Executive Version (0.3) on August 27, 2000. This plan was developed under the assumption that a central body should handle Showcase CM on a corridor-wide basis. This concept originated prior to the CWSPP, and can be found in Steering Committee handouts from early 1997. The 53-page "Executive Version" contained 12 sections, including:

- ▶ Section 1 – an overview of CM.
- ▶ Section 2 – a list of reference documents, such as the Software Engineering Institute's (SEI's) Capability Maturity Model (CMM).
- ▶ Section 3 – a description of an organizational structure for managing CM, including several staff positions such as a CM Subcommittee Chairperson, CM Facilitator, Quality Assurance Manager, a CM Technical Team (CMTT), and an Interface Control Working Group (ICWG). Section 3 also proposes that the CM program budget come out of the Priority Corridor budget.
- ▶ Section 4 – a list of general items that typically come under CM.

- ▶ Section 5 – a method and taxonomy for identifying and labeling configuration items (CIs).
- ▶ Section 6 – a description of Interface Management.
- ▶ Section 7 – a detailed Change Management process, including change classifications and an appeals process.
- ▶ Section 8 – a Configuration Status Accounting method for tracking which CI versions are current and which ones are obsolete.
- ▶ Section 9 – an explanation of Configuration Audits, which verify a project’s compliance with the CM Plan.
- ▶ Section 10 – requirements for appropriate CM language/tasks in future workplans and RFPs.
- ▶ Section 11 – a description of the CM program planning/budgeting activities that should be undertaken to ensure that resources are available to sustain the CM program.
- ▶ Section 12 – a description of a number of procedures for an ongoing evaluation and improvement of the CM Plan/process.

The Executive Version of the CMP was presented to the CM Subcommittee at its August 29, 2000 kick-off meeting. Due to the far-reaching implications of the plan, the CM Subcommittee requested that the project team distribute the CMP to Priority Corridor stakeholders for review and comment.

Comments regarding version 0.3 of the plan were accepted during the month of September, and the CMP was revised several times throughout October 2000. Version 0.4 incorporated comments from the Steering Committee, CM Subcommittee, and other staff. Version 0.5 incorporated an executive summary, and versions 0.6 and 0.7 made additional editorial changes. Version 0.7 of the document was declared “Draft Final” on October 30 and was posted to the Priority Corridor’s website for further review and comment.

At the November 2000 Steering Committee meeting, several members expressed concern over the impact that the CMP’s resource and staffing requirements would have on their respective agencies. The Steering Committee requested that the CMP be revised again, and that the resources issue be addressed at the next Steering Committee meeting in December. The CMP was revised to version 0.8 in mid-November to update the Priority Corridor’s project organization.

The revised plan was presented to the Steering Committee at its December 2000 meeting, where it was approved by a majority of the voting members. The final revision to version 1.0 was made the following week. The resource issue brought up at the November meeting was handled separately in the first draft of the Showcase Program Director’s “Showcase Sustainability” whitepaper. This whitepaper took the first step towards estimating Showcase’s operations and

maintenance (O&M) resource needs (including CM, telecommunications, etc.) and identifying potential funding sources.

Once the CMP was finalized, most of the CWSPP team's efforts in 2001 turned towards implementing the plan and developing the Systems Integration Plan. The Steering Committee and other Corridor stakeholders continued to mull the CMP throughout 2001 and into 2002; the primary issues continued to be (1) the availability of regional software source code to validate the documented IDL, and (2) identification of funding to support CM activities.

Ultimately, in recognition of the Priority Corridor's regional planning and funding structure, the Steering Committee determined that each region shall be responsible for the CM of its own respective systems and that Caltrans shall be responsible for the CM of the interregional Showcase "backbone" (i.e., the Kernels).

3.1.2 Systems Integration Plan (SIP)

The SIP is the only document to take a corridor-wide view of integrating all of the systems being developed by Showcase projects. By its nature, the plan required a thorough understanding of each system, and how those systems might interface to work together as a unit. Although the CWSPP consultant, TransCore, was not a system developer or system integrator on any of the Showcase projects, it was familiar with the high-level Showcase architecture through previous work and its ongoing association with the Priority Corridor. In order to obtain more detailed information about the individual projects and systems, TransCore regularly attended and participated in project meetings, reviewed system requirements and design documents (also obtained as part of its ongoing CM work), and held discussions with the various system developers.

Development of the plan occurred over 14 months, as described by the milestones below:

7/26/2000 – Draft A (outline) of System Integration Plan

10/23/2000 – Draft B of System Integration Plan

1/19/2001 – Draft D of System Integration Plan

3/19/2001 – Draft E-H of System Integration Plan

3/30/2001 – Draft Final (version 1.0) of System Integration Plan

4/26/2001 – Draft Final (version 1.1) of System Integration Plan

6/29/2001 – Draft Final (version 1.2) of System Integration Plan

7/9/2001 – Draft Final (version 1.2) System Integration Plan widely distributed to Priority Corridor stakeholders for review and comment.

8/29/2001 – Response to comments on System Integration Plan (version 1.2)

8/31/2001 – Revised Systems Integration Plan (version 1.3)

9/28/2001 – Final Systems Integration Plan (still version 1.3)

The final SIP (August/September 2001) provides technical overviews of the individual (regional) Showcase projects, and identifies several requirements and next steps for moving towards corridor-wide integration, including⁶:

- ▶ *“Most of the projects can view, on a map, information referenced to a location only within their regional boundary. Therefore, although the regional systems are being designed to exchange data interregionally (i.e., corridor-wide), their user interfaces cannot display the data that comes from outside the immediate region.”*
- ▶ *“Two of the Priority Corridor projects, TravelTIP and InterCAD, are each designed to use their own communications networks that are separate and independent from the Showcase Network. Since TravelTIP is the only source of information from Orange County, this leaves a tremendous information gap in the heart of the corridor.”*
- ▶ *“Freeway incident data is only available on the Priority Corridor network for the Los Angeles-Ventura region. In the other regions, in order to be capable of providing this information, the Caltrans system at their TMCs needs to be further upgraded. Lack of corridor-wide freeway incident information is a second serious information gap in the corridor.”*

Even as work on the SIP began in July 2000, ten of the remaining 16 Showcase projects were already underway, and six of those (shown in Exhibit 7) were either well into system implementation or nearing completion. These six projects included the five designated projects on which the CWSPP was focused (marked with *). The CWSPP team understood that it would not be feasible within those projects to address the identified “next steps,” and that these modifications would have to be deferred to subsequent software revisions and hardware upgrades during future projects.

Exhibit 7 – Anticipated Completion Dates (as of July 2000) for Six Showcase Projects

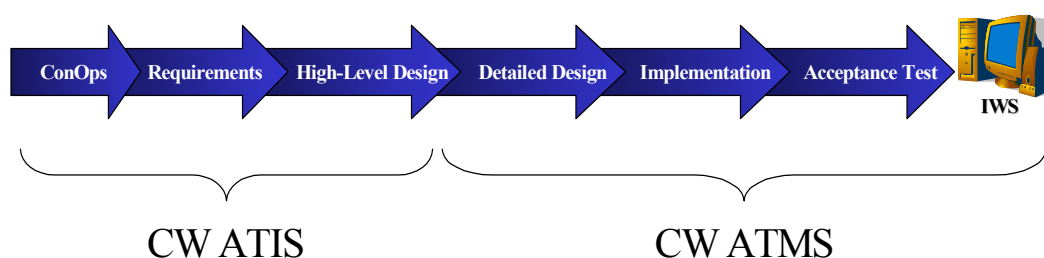
Project Name	Anticipated Completion Date as of July 2000	2000						2001					
		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
InterCAD*	12/31/99					Project Completed							
IMAJINE*	9/2000												
Kernel*	10/2000												
Mission Valley*	5/2001												
OCMDI	8/2000												
TravelTIP*	10/2000												

* Identifies the five projects being studied by CWSP

As a solution, the SIP introduced the concept of an Integrated Workstation (IWS). The IWS would combine and integrate all of the services and functionality of the regional workstations (namely, the workstations developed under IMAJINE, TravelTIP, and Mission Valley ATMIS) into a single application designed to provide corridor-wide information sharing and device control.

To build the IWS, the Steering Committee approved the use of the Showcase funds associated with two projects that were not yet underway: the Corridor-wide Advanced Traveler Information System (CWATIS) project and the Corridor-wide Advanced Transportation Management System (CWATMS) project. The workplans for these two Showcase projects were subsequently revised to include the design and implementation of the IWS.

The CWATIS project, which is nearly complete as of the writing of this report, is tasked with developing the Concept of Operations, Requirements, and High-Level Design for the IWS. The CWATMS project, not yet underway, will build on the CWATIS effort by developing the Detailed Design and implementing the IWS as described in Exhibit 8.

Exhibit 8 – Relationship Between the CWATIS and CWATMS Projects

3.2 Impact of Showcase Integration on Project Deployment and System Performance

This section describes the impacts of the CWSPP on other Showcase projects, as well as the impacts of other Showcase projects on the CWSPP.

3.2.1 Impact of CWSPP on other Showcase Projects

Identification of Integration Gaps and Issues

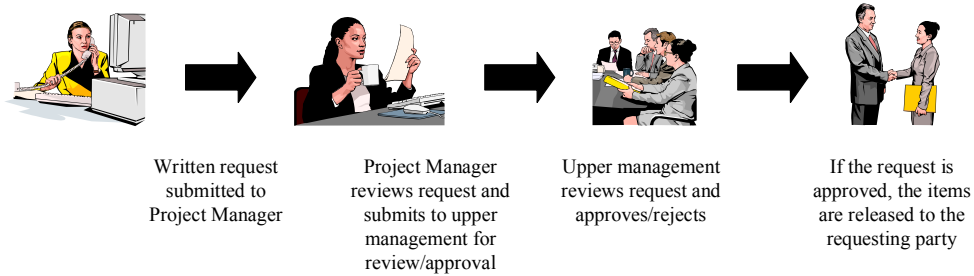
The CWSPP team participated in meetings and collected and reviewed documentation for the five designated projects on which it was focused. Through its involvement at the monthly project meetings, and its interviews with the system developers, the team was able to develop an understanding of each regional system as both a stand-alone entity as well as a part of an integrated, corridor-wide system.

Although the SIP documented several integration gaps facing the selected regional projects, these projects were all perceived to be too far along in their development to remedy the issues without significant additional cost and delay. As an alternative, the SIP proposed the development of a next-generation “Integrated Workstation” (IWS) with enhanced features to replace earlier workstations and fill the integration gaps. The CWATIS and CWATMS projects are respectively tasked with designing and building the IWS within their existing budget allocations (roughly \$1.1M total).

3.2.2 Impact of other Showcase Projects on CWSPP

The Priority Corridor’s Regional Planning and Funding Structure

Each of the four regions within the Priority Corridor is responsible for its own transportation planning and funding. The CMP’s recommendation to establish a central body to handle CM corridor-wide conflicted with this regional alignment in that there was no clear funding source. The “centralized CM” that the CWSPP initially proposed would also have required all agencies managing Showcase projects to turn over project deliverables such as documentation and software source code to the body managing CM for the corridor. This body would act as an information clearinghouse and design review team, and would have the authority to release these deliverables to any consultants who are subsequently hired to design, develop, upgrade or modify any Showcase-related systems. This further raised questions regarding software ownership and intellectual property rights. Although most agencies are free to share documentation with third parties, careful review and management approval is often required for the release of agency-owned software. Many agencies follow a formal process (depicted in Exhibit 9) that requires a written request, review by the project manager, review by legal counsel, then review and final approval/rejection by an executive director or management board.

Exhibit 9 – General Process for Requesting Software Deliverables from a Public Agency

Since planning and funding are generally done at the regional level, the Steering Committee directed at its May 2002 meeting that each region shall be responsible for the CM of its own systems up to the interface with the interregional Showcase Network (i.e., the Kernels). Caltrans shall take responsibility for the Kernels and the infrastructure that makes up the interregional portion of the Showcase Network.

4 Cost Evaluation

The cost evaluation draws information from documented costs and personal interviews. Budget information was taken directly from the project's contract and amendments, while operations and maintenance costs were obtained from discussions with agency personnel. Informal interviews were conducted to verify information and fill in any "holes" that were discovered during analysis.

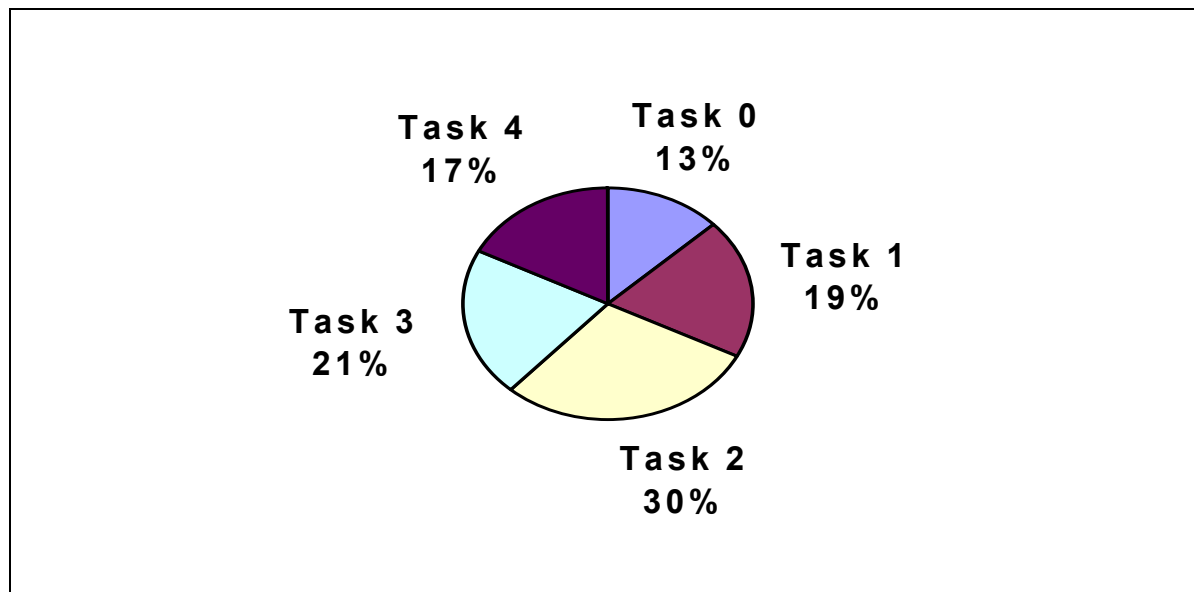
4.1 Project Budget & Estimated Development Costs

\$475,000 was made available to the CWSPP contract to support five tasks, whose budget allocations are shown in Exhibits 13 and 14. Since the project was negotiated as a fixed-price contract, the budgets shown below might not accurately reflect actual costs and expenditures per task.

Exhibit 10 - CWSPP Budget per Task

Cost Item	Budget \$	Budget %
Task 0 – Project Management	\$62,104	13.1%
Task 1 – Develop CM Plan	\$91,692	19.3%
Task 2 – Implement CM Plan	\$138,538	29.2%
Task 3 – System Integration & Analysis	\$100,046	21.1%
Task 4 – Develop System Integration Plan	\$82,620	17.4%
Total	\$475,000	100.0%

Note that an additional \$150,000 paid for Caltrans NTR staff time to manage and work the project.

Exhibit 11 – Percent Distribution of CWSPP Budget by Task

4.2 Estimated Operations & Maintenance Costs

4.2.1 Operations

The current direction of the Priority Corridor Steering Committee is that CM of regional systems will be handled by the respective regional partner agencies, and that Caltrans will handle CM of the Kernel and interregional communications “backbone.”

4.2.1.1 Labor

The Regional Transportation Planning Agencies (i.e., LACMTA, OCTA, SANDAG, and SANBAG) will likely take on the CM activities for their respective regions without adding staff or hiring contractors. No additional CM-related funding is anticipated, although CM responsibilities will occasionally add to the workloads of these agencies’ staff. Anticipated CM-related tasks and responsibilities include:

- ▶ Reviewing project workplans for potential system impacts.
- ▶ Verifying that contracts contain appropriate language with respect to required system interfaces and specifications.
- ▶ Responding to requests for information, documentation, and sample software source code.

4.2.1.2 Utilities

Since CM will fit into existing practices, no additional equipment will be required. There is no ongoing cost for the System Integration Plan.

4.2.1.3 Office Space

Most agencies maintain their own libraries or repositories of project deliverables, which are now often archived on space-saving CDs. There should be no additional cost for storage of deliverables and other materials under CM.

4.2.2 Maintenance

4.2.2.1 Labor

Outside an agency's existing policy/procedure review process, there should be no additional cost for maintaining or periodically revising the CM process.

5 Institutional Impacts Evaluation

This chapter describes the institutional impacts of the project, including impacts to agency Operations and Maintenance (O&M) policies, agency staff levels and training, the competitive environment, and local planning processes and the mainstreaming of ITS. Each of these areas is addressed in the sections that follow.

5.1 *Impacts to Operations and Maintenance Procedures and Policies*

Roughly 15 months after its finalization, the Priority Corridor elected to implement a scaled-back version of the CMP. The Steering Committee found early versions of the plan to be prohibitively rigorous and unsupportable within Showcase's current resources. It was also unclear how the partner agencies would mainstream and continue to support the CM activities beyond the federally subsidized Showcase Program. Since Caltrans NTR had managed the project, some believed that Caltrans should entirely support the CM activities. However, by its charter, Caltrans NTR is strictly a research organization, and may not operate or maintain any systems or infrastructure. For Caltrans to accept this responsibility, CM would have to be transferred out of the Division of New Technology and Research to either HQ IT or the Operations division.

Furthermore, each of the four regions within the Priority Corridor is responsible for its own transportation planning and funding, and the CMP's recommendation to establish a central body to handle CM for the entire corridor conflicted with this regional alignment.

Since the CMP was developed under the management of Caltrans NTR, the Steering Committee determined that the reach of the plan should be scaled back to include only the corridor-wide components that would be managed by Caltrans, such as the Kernels and interregional network. Systems procured by the regional partners would be managed by the respective agencies under their existing policies, unless some other arrangement is made. In this way, the systems would become mainstreamed into the agencies' existing O&M frameworks.

Corridor-wide interoperability will be achieved through required compliance to the Showcase Program's protocols and technical standards, as defined in its Interface Definition Language (IDL). Each contracting agency will be responsible for specifying these system requirements in future projects (perhaps in the RFPs, but especially in the System Requirements documents), and then providing documentation of the standards (i.e., IDL) to the selected contractors. The contractors will be responsible for satisfying these requirements and, ultimately, providing the interoperable systems.

5.2 *Impacts to Staffing, Skill Levels and Training*

As stated in section 4.2.1.1, the responsibility for CM will likely fall on existing agency staff. Assuming that future projects will require compliance with Showcase standards (i.e., the IDL),

agency staff may eventually be faced with the situation in which a consultant wants to modify these standards. Considering that such a modification may or may not be justified, and that it could impact the entire Showcase Network, the contracting agency's staff should be prepared to manage the situation. This might be handled in a number of ways:

- ▶ The contracting agency consults with an objective third-party technical consultant who reviews the proposed modification
- ▶ The contracting agency assigns staff who are already familiar with the technology
- ▶ The contracting agency provides overview training in information technologies (such as object-oriented software design, CORBA, XML, etc.) to staff who are not currently familiar with the technologies

5.3 Impacts to Local Planning Processes, Policy Development, and the Mainstreaming of ITS

Due ultimately to the regional planning and funding structure of the Priority Corridor, the Steering Committee determined that CM of regional ITS should be mainstreamed and handled by the respective regional partners. This appears to be leading to the development of four independent regional ITS networks in Southern California that will eventually be inter-connected by an interregional communications "backbone" managed by Caltrans.

6 Findings and Recommendations

In summary, the Evaluation of the CWSPP resulted in the following findings and recommendations:

1. Per its work scope, the CWSPP team delivered both a Configuration Management Plan (CMP) and a Systems Integration Plan (SIP).
2. The CMP raised questions and disagreements over intellectual property rights and the ownership of publicly funded, custom-made software. Reviews of several Showcase project contracts revealed that agencies in the Priority Corridor vary in their attention to – and treatment of – intellectual property rights (IPR) and software ownership rights when they hire consultants to design and develop custom-made software. Although each agency has its own unique circumstances and the right to set its own policies, there may be advantages to developing and adopting a more standard and universal IPR/software ownership policy throughout the Priority Corridor.
3. The CMP proposed a “centralized” approach to configuration management in which a single entity would become the Showcase Network’s point-of-contact, information clearinghouse, and configuration manager for the entire multi-regional Priority Corridor. Although the CMP was rigorous in describing an ideal configuration management system, its “centralized” approach conflicted with the Corridor’s regionally-based planning and funding structure. Ultimately, the Steering Committee determined that the CMP should not apply to regional systems, and should only apply to the Corridor’s interregional components maintained by Caltrans (i.e., the Kernels and interregional network).
4. CM activities will be mainstreamed within the Regional Transportation Planning Agencies (i.e., LACMTA, OCTA, and SANDAG) and Caltrans. No federal funding for CM is anticipated.
5. The SIP identified several technical gaps limiting the interregional integration of the five Showcase projects/systems that it studied. Since these five projects were considered to be near completion, the CWSPP team recognized that these integration gaps would have to be dealt with in future projects. The SIP introduced the concept of an enhanced, “next-generation” Integrated Workstation (IWS) to replace the first-generation regional workstations that were being deployed. The Corridor-wide Advanced Traveler Information System (CWATIS) project is currently developing the Concept of Operations, Requirements, and High-Level Design for the IWS. A future project, the Corridor-wide Advanced Transportation Management System (CWATMS) project, will develop the Detailed Design and implement the IWS.

References/End Notes

(1) ISTEA requires that “operational tests utilizing federal funds have a written evaluation of the Intelligent Vehicle Highway Systems technologies investigated and the results of the investigation.” Although Showcase is not an officially an operational test, it deploys and demonstrates ITS services, functions, and technologies under “real world” conditions, similar to an operational test.

(2) California Statistical Abstract, Table B-4. CA Department of Finance, Sacramento, CA. October 2001.

(3) California Statistical Abstract, Table J-4. CA Department of Finance, Sacramento, CA. October 2001.

(4) California Statistical Abstract, Table J-4. CA Department of Finance, Sacramento, CA. Years 1988-2001.

(5) National Transit Database 2000, Table 24. USDOT/Federal Transit Administration (FTA), Washington, DC. 2000

(6) CWSPP Systems Integration Plan. TransCore, September 2001. pp. 5-7.

(7) Showcase Program Director’s Monthly Report, “Status of On-Going and Approved Projects” October 2001.

(8) *ibid.*